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(54) Vehicle radial tire

(57) A vehicle tire (1) wherein each bead portion (1a) is defined by a metal bead-bead filler assembly (10), and by a portion (6, 7, 8) of a reinforced body ply (4) outwardly covered by a layer (13) of elastomeric material and folded in a U about the assembly (10); and wherein the bead filler (12) is a composite filler defined by a triangular filler element (21) located radially outwards of the bead (11), by an apex layer (22) with a high modulus of elasticity and partially interposed between an apex of the triangular filler element (21) and an inner intermediate portion (6) of the reinforced body ply (4), and by a further apex layer (23) reinforced internally and partially interposed between the apex of the triangular filler element (21) and an outer upturned portion (7) of the reinforced body ply (4).

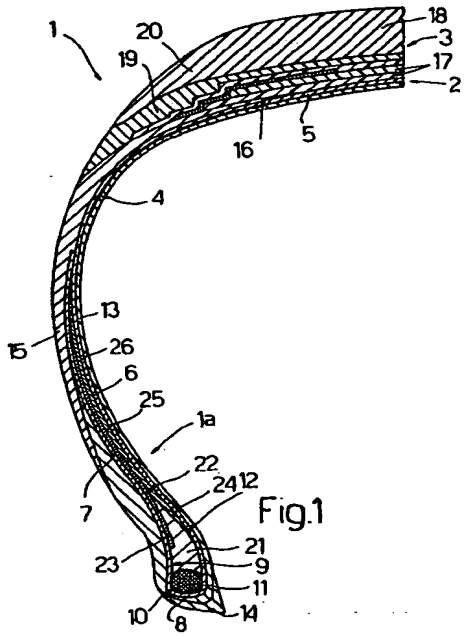

Fig.1

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Description

The present invention relates to a vehicle radial tire.

Vehicle radial tires normally present, along the inner periphery, two metal beads, each of which is fitted along its outer periphery with a filler of elastomeric material, normally in the form of a substantially triangular-section wing. Each bead and respective filler are covered with a respective upturned U-shaped lateral portion of a body ply, the upturned end portion of which joins the outer surface of the central portion of the body ply over the outer end of the filler. The surface, facing inwards of the tire, of the assembly so formed is normally covered with an innerliner; the surface of the assembly facing outwards of the tire is normally covered with an abrasion strip; and the innerliner and abrasion strip are integral with each other and folded about the respective said lateral portion of the body ply.

As is known, the main function of the fillers, which are normally made of elastomeric material with a high modulus of elasticity and a Shore hardness of 85-95°, is to ensure the lateral stability of the tire by defining, inside the tire, a leaf spring element for smoothing the passage, elastically speaking, between the relatively rigid beads and the relatively flexible lateral walls. In other words, the main function of the fillers is to achieve a high "steering capability" of the tire, i.e. ensure that, in use, the tire responds to external stress with no unexpected deformation.

The steering capability of known tires is normally enhanced by increasing the rigidity of the filler material and/or by using fillers as high as possible to increase their mass.

Both solutions present drawbacks. On the one hand, excessively rigid fillers reduce the fatigue resistance of the tires, while, on the other, increasing the height and mass of the fillers makes them difficult to handle, impairs the shape stability of the fillers, and results in an undesired increase in the weight of the tires.

It is an object of the present invention to provide a radial tire of such a structure as to enable straightforward manufacture, while at the same time enhancing the steering capability and reducing the weight of the tire as compared with known tires of the same type.

According to the present invention, there is provided a vehicle radial tire, the tire being of the type comprising two bead portions, each in turn comprising a metal bead-bead filler assembly; and a reinforced body ply folded into a U about said assembly and comprising an inner intermediate portion and an outer upturned portion; said bead filler comprising a triangular filler element located radially outwards of the respective said bead; and being characterized in that said bead filler is a composite filler, and also comprises an apex inner layer, preferably a layer of substantially constant thickness defined by a calendered liner, presenting a relatively high modulus of elasticity; said inner layer being partially interposed between an apex of the triangular filler element and said inner intermediate portion of the reinforced body ply.

According to a preferred embodiment of the present invention, said bead filler also comprises a reinforced apex outer layer, preferably an internally reinforced layer of substantially constant thickness, which is partially interposed between an apex of the triangular filler element and said outer upturned portion of the reinforced body ply.

In the above preferred embodiment, said inner layer preferably forms an elastic cushion for supporting and connecting an end of said outer layer to said inner intermediate portion of the reinforced body ply.

For this purpose, said inner layer preferably comprises a first end portion interposed between the apex of the triangular filler element and said inner intermediate portion of the reinforced body ply; an intermediate portion interposed between said outer layer and said inner intermediate portion of the reinforced body ply; and a second end portion interposed between said outer upturned portion and said inner intermediate portion of the reinforced body ply.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic, partially exploded cross section of a preferred embodiment of the tire according to the present invention;

Figure 2 shows a schematic spreadout view of a portion of the Figure 1 tire at one stage of construction.

Number 1 in Figure 1 indicates a vehicle tire comprising an inner toroidal carcass 2 and an outer annular assembly indicated as a whole by 3.

Carcass 2 comprises a substantially toroidal reinforced body ply 4, in turn comprising a substantially cylindrical inner central portion 5 located inside annular assembly 3, two annular inner intermediate portions 6 (only one shown) located on either side of and integral with central portion 5, and two annular outer upturned portions 7 (only one shown), each of which is made integral with respective intermediate portion 6 by means of a curved portion 8.

A free edge of each upturned portion 7 is placed directly contacting a portion of respective intermediate portion 6, so as to define, with intermediate portion 6 and respective curved portion 8, a substantially closed annular chamber 9 housing an assembly 10 defined by a metal bead 11 and by a bead filler 12 extending radially outwards from bead 11.

Carcass 2 also comprises an innerliner 13 covering portions 5, 6 and 8 of body ply 4; two abrasion strips 14 (only one shown) located on either side of innerliner 13 and each surrounding a respective curved portion 8; and two sidewalls 15 (only one shown), each located outwards of respective abrasion strip 14.

Each upturned portion 7, together with respective

intermediate portion 6, respective curved portion 8, respective abrasion strip 14, respective sidewall 15 and respective assembly 10, defines a respective bead portion 1a of tire 1.

As shown in Figure 1, annular assembly 3 comprises a substantially cylindrical tread belt 16 comprising one or more superimposed tread plies 17 and extending outwards of central portion 5 of body ply 4; and a tread 18, which is anchored to tread plies 17 via the interposition of a cushion 19, and comprises two shoulders 20 (only one shown), each of which is connected by cushion 19 to a free end of a respective sidewall 15.

As shown in Figure 1, each bead filler 12 is a composite filler comprising an extruded triangular filler element 21 located radially outwards of respective bead 11, and an apex inner layer 22. Element 21 and inner layer 22 are made of similar but not necessarily identical material with a relatively high modulus of elasticity and a Shore hardness of generally over 80°; and inner layer 22 is preferably defined by a calendered liner presenting a constant thickness of about 1-2 mm, and partially interposed between an apex of element 21 and respective inner intermediate portion 6 of body ply 4.

As shown in Figure 1, each bead filler 12 also comprises a reinforced apex outer layer 23 partially interposed between an apex of triangular filler element 21 and outer upturned portion 7 of body ply 4. Outer layer 23 presents a substantially constant thickness of the same order as that of body ply 4, and is reinforced internally with wires or textile cords (not shown) extending in a direction forming a given angle with the cords (not shown) of body ply 4.

Outer layer 23 extends outwards, in relation to respective bead 11, to a lesser degree than inner layer 22 and outer upturned portion 7 of body ply 4. More specifically, inner layer 22 forms an elastic cushion for supporting and connecting a free outer end of outer lay r 23 to inner intermediate portion 6 of body ply 4. For which purpose, inner layer 22 comprises a first end portion 24 interposed between the apex of element 21 and inner intermediate portion 6 of body ply 4; an intermediat portion 25 interposed between outer layer 23 and inner intermediate portion 6 of body ply 4; and a second end portion 26 interposed between outer upturned portion 7 and inner intermediate portion 6 of body ply 4.

Preferably, and as shown in Figure 2, both inner lay r 22 and outer layer 23 are preassembled to body ply 4, normally on a known building drum 27, prior to forming carcass 2 and turning up outer upturned portion 7 of body ply 4, to simplify the manufacture of tire 1 and at the same time position bead filler 12 extremely accurately in relation to body ply 4.

In tire 1 as described above, the addition of inner layer 22 provides, in an extremely straightforward, low-cost manner, for extending triangular filler element 21 outwards in relation to the respective bead 11, thus eliminating any instability of element 21, and also for adjusting the elastic response of tire 1 to transverse loads with no substantial increase in weight.

As regards the low cost of layer 22, it should be pointed out that layer 22 is not only a calendered layer, and therefore much cheaper than a corresponding extruded element, but is also cheap and easy to apply by virtue, as stated, of the possibility of being preassembled to body ply 4 prior to forming carcass 2. Moreover, inner layer 22 also provides for further controlling the lateral deformability of the sidewalls of tire 1 by the addition of layer 23, which would be difficult to apply in the absence of a cushioning layer, such as inner layer 22, capable of absorbing the fatigue stress generated between body ply 4 and the outer end of layer 23.

Claims

1. A vehicle radial tire, the tire (1) being of the type comprising two bead portions (1a), each in turn comprising an assembly (10) of a metal bead (11) and a bead filler (12); and a reinforced body ply (4) folded about said assembly (10) and comprising an inner intermediate portion (6) and an outer upturned portion (7); said bead filler (12) comprising a triangular filler element (21) located radially outwards of the respective said bead (11); and being characterized in that said bead filler (12) is a composite filler (12), and also comprises an apex inner layer (22) presenting a relatively high modulus of elasticity; said inner layer (22) being partially interposed between an apex of the triangular filler element (21) and said inner intermediate portion (6) of the reinforced body ply (4).

2. A tire as claimed in Claim 1, characterized in that said inner layer (22) presents a substantially constant thickness.

3. A tire as claimed in Claim 1 or 2, characterized in that said inner layer (22) presents a thickness in the order of 1-2 mm.

4. A tire as claimed in Claim 2 or 3, characterized in that said inner layer (22) is defined by a calendered liner.

5. A tire as claimed in Claim 2, 3 or 4, characterized in that said inner layer (22) and said triangular filler element (21) are made of materials presenting similar chemical-physical characteristics.

6. A tire as claimed in one of the foregoing Claims from 2 to 5, characterized in that said inner layer (22) is a layer preassembled on to a surface of said reinforced body ply (4).

7. A tire as claimed in any one of the foregoing Claims, characterized in that said bead filler (12) also comprises a reinforced apex outer layer (23) partially

interposed between an apex of the triangular filler element (21) and said outer upturned portion (7) of the reinforced body ply (4).

8. A tire as claimed in Claim 7, characterized in that said inner intermediate portion (6) and said outer upturned portion (7) of the reinforced body ply (4) are located directly contacting each other to define a closed annular chamber (9) housing the respective bead (11), the respective triangular filler element (21) and the respective inner (22) and outer (23) layers.

9. A tire as claimed in Claim 7 or 8, characterized in that said outer layer (23) is an internally reinforced layer.

10. A tire as claimed in Claim 9, characterized in that said outer layer (23) presents a substantially constant thickness of the same order as the thickness of said reinforced body ply (4).

11. A tire as claimed in one of the foregoing Claims from 7 to 10, characterized in that said inner layer (22) constitutes an elastic cushion for connecting an end of said outer layer (23) to said inner intermediate portion (6) of the reinforced body ply (4).

12. A tire as claimed in Claim 11, characterized in that said inner layer (22) comprises a first end portion (24) interposed between the apex of the triangular filler lement (21) and said inner intermediate portion (6) of the reinforced body ply (4); an intermediate portion (25) interposed between said outer layer (23) and said inner intermediate portion (6) of the reinforced body ply (4); and a second end portion (26) interposed between said outer upturned portion (7) and said inner intermediate portion (6) of the reinforced body ply (4).

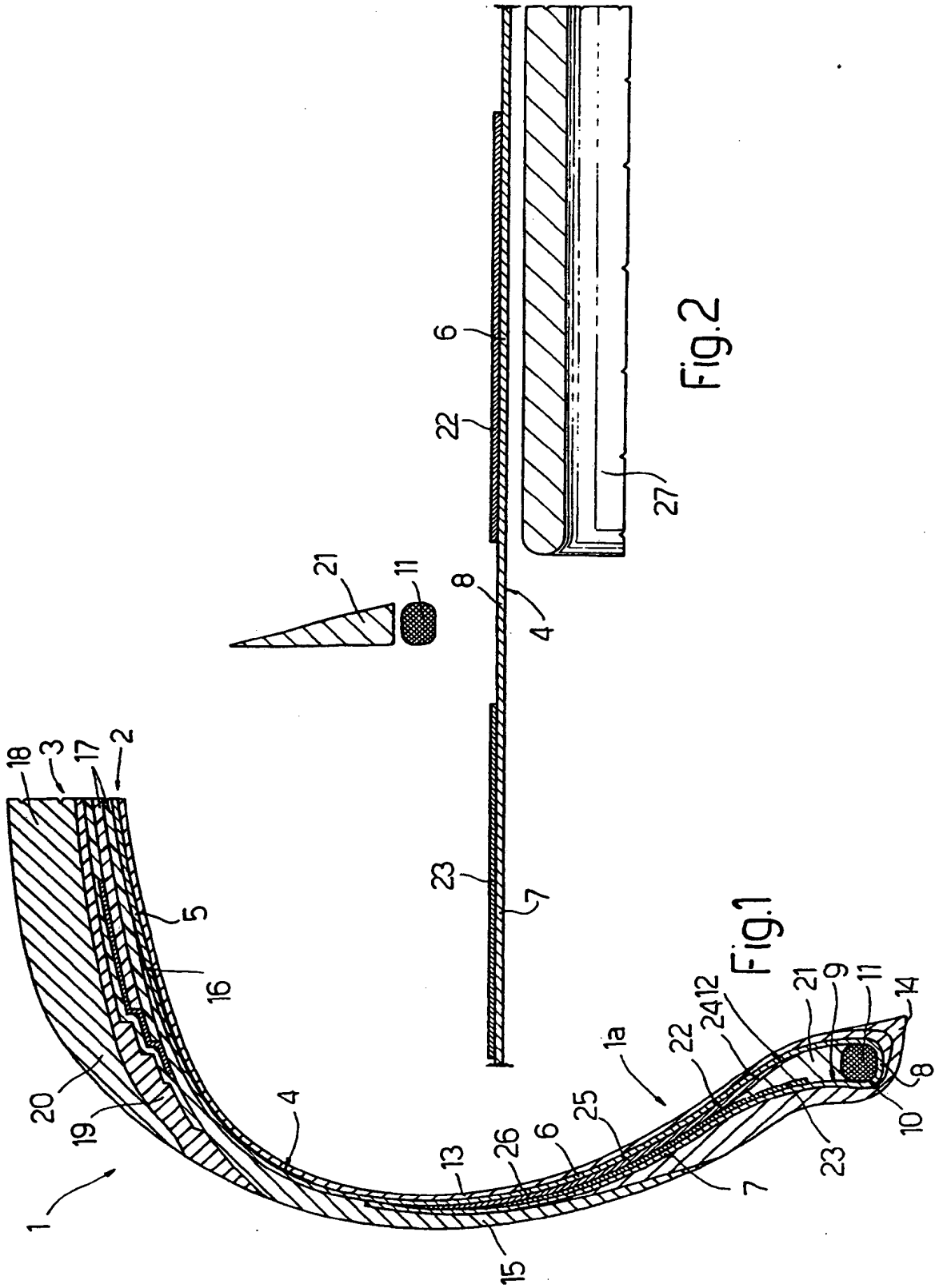

Fig.2

Fig.1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 12 0267

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 117 888 A (KUNIHIKO SHIMIZU) * column 4, line 4 - column 5, line 14; figure 2 *	1-6	B60C15/06
A	FR 2 013 540 A (THE DUNLOP COMPANY LIMITED) * page 3, line 12 - page 5, line 5; figure 1 *	1-12	
A	FR 2 286 014 A (UNIROYAL AG) * figure 7 *	1-12	
A	EP 0 465 188 A (SUMITOMO RUBBER INDUSTRIES LIMITED) * figure 6 *	1	
A	US 3 406 733 A (J. BOILEAU) * the whole document *	5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) C03C B60C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 April 1997	Reedijk, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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